

Replication of Berry et al. (1995)

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This document describes our MATLAB implementation of Berry et al.'s (1995) model of automobile demand (henceforth BLP).

We obtained BLP (1995)'s data from the GAUSS code for BLP (1999), which we downloaded from the Internet Archive's April 2005 web capture of James Levinsohn's (now defunct) website at the University of Michigan. Table 1 of BLP (1995) and table 2 of BLP (1999) imply that the two papers use the same dataset.

We re-implemented BLP's (1995) estimator using BLP's (1999) code as a guide. We used code from Petrin (2002), Dubé et al. (2012), and Knittel and Metaxoglou (2014) as additional references.

The tables below reproduce the corresponding tables from BLP (1995) alongside analogous results from our implementation.

We reproduce the descriptive statistics in tables 1, 2, and 3 very closely, matching exactly or almost exactly in most cases. Model parameter estimates in table 4 are similar in general, but our estimated parameters produce somewhat lower price elasticities (table 5), leading to somewhat higher estimated markups (table 8).

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References

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Table 1: Descriptive statistics

(a) Berry et al. (1995)

Year	No. of		Quantity	Price	Domestic	Japan	European	HP / weight	Size	Air	MPG	MP\$
	models											
1971	92		86.892	7.868	0.866	0.057	0.077	0.490	1.496	0.000	1.662	1.850
1972	89		91.763	7.979	0.892	0.042	0.066	0.391	1.510	0.014	1.619	1.875
1973	86		92.785	7.535	0.932	0.040	0.028	0.364	1.529	0.022	1.589	1.819
1974	72		105.119	7.506	0.887	0.050	0.064	0.347	1.510	0.026	1.568	1.453
1975	93		84.775	7.821	0.853	0.083	0.064	0.337	1.479	0.054	1.584	1.503
1976	99		93.382	7.787	0.876	0.081	0.043	0.338	1.508	0.059	1.759	1.696
1977	95		97.727	7.651	0.837	0.112	0.051	0.340	1.467	0.032	1.947	1.835
1978	95		99.444	7.645	0.855	0.107	0.039	0.346	1.405	0.034	1.982	1.929
1979	102		82.742	7.599	0.803	0.158	0.038	0.348	1.343	0.047	2.061	1.657
1980	103		71.567	7.718	0.773	0.191	0.036	0.350	1.296	0.078	2.215	1.466
1981	116		62.030	8.349	0.741	0.213	0.046	0.349	1.286	0.094	2.363	1.559
1982	110		61.893	8.831	0.714	0.235	0.051	0.347	1.277	0.134	2.440	1.817
1983	115		67.878	8.821	0.734	0.215	0.051	0.351	1.276	0.126	2.601	2.087
1984	113		85.933	8.870	0.783	0.179	0.038	0.361	1.293	0.129	2.469	2.117
1985	136		78.143	8.938	0.761	0.191	0.048	0.372	1.265	0.140	2.261	2.024
1986	130		83.756	9.382	0.733	0.216	0.050	0.379	1.249	0.176	2.416	2.856
1987	143		67.667	9.965	0.702	0.245	0.052	0.395	1.246	0.229	2.327	2.789
1988	150		67.078	10.069	0.717	0.237	0.045	0.396	1.251	0.237	2.334	2.919
1989	147		62.914	10.321	0.690	0.261	0.049	0.406	1.259	0.289	2.310	2.806
1990	131		66.377	10.337	0.682	0.276	0.043	0.419	1.270	0.308	2.270	2.852
All	2217		78.804	8.604	0.790	0.161	0.049	0.372	1.357	0.116	2.099	2.086

(b) Replication

Year	No. of		Quantity	Price	Domestic	Japan	European	HP / weight	Size	Air	MPG	MP\$
	models											
1971	92		86.892	7.868	0.866	0.057	0.077	0.490	1.496	0.000	1.662	1.849
1972	89		98.623	7.979	0.892	0.042	0.066	0.391	1.510	0.014	1.619	1.875
1973	86		92.785	7.535	0.932	0.040	0.028	0.364	1.529	0.022	1.589	1.818
1974	72		105.119	7.506	0.887	0.050	0.064	0.347	1.510	0.026	1.567	1.452
1975	93		84.775	7.821	0.853	0.083	0.064	0.337	1.479	0.054	1.584	1.503
1976	99		93.382	7.787	0.876	0.081	0.043	0.338	1.508	0.059	1.759	1.696
1977	95		97.727	7.651	0.837	0.112	0.051	0.340	1.467	0.032	1.947	1.835
1978	95		99.444	7.645	0.855	0.107	0.039	0.346	1.405	0.034	1.982	1.929
1979	102		82.742	7.599	0.803	0.158	0.038	0.348	1.343	0.047	2.061	1.657
1980	103		71.567	7.718	0.773	0.191	0.036	0.350	1.296	0.078	2.215	1.466
1981	116		62.030	8.349	0.741	0.213	0.046	0.349	1.286	0.094	2.363	1.559
1982	110		61.893	8.831	0.714	0.235	0.051	0.347	1.277	0.134	2.440	1.817
1983	115		67.878	8.821	0.734	0.215	0.051	0.351	1.276	0.126	2.601	2.087
1984	113		85.933	8.870	0.783	0.179	0.038	0.361	1.293	0.129	2.469	2.117
1985	136		78.143	8.938	0.761	0.191	0.048	0.372	1.265	0.140	2.261	2.024
1986	130		83.756	9.382	0.733	0.216	0.050	0.379	1.249	0.176	2.416	2.856
1987	143		67.667	9.965	0.702	0.245	0.052	0.395	1.246	0.229	2.327	2.789
1988	150		67.078	10.069	0.717	0.237	0.045	0.396	1.251	0.237	2.334	2.919
1989	147		62.914	10.321	0.690	0.261	0.049	0.406	1.259	0.289	2.310	2.806
1990	131		66.377	10.337	0.682	0.276	0.043	0.419	1.270	0.308	2.270	2.852
All	2217		78.804	8.604	0.790	0.161	0.049	0.372	1.357	0.116	2.099	2.086

Table 2: The range of continuous demand characteristics (and associated models)

(a) Berry et al. (1995)		(b) Replication				
Variable	Percentile					
	0	25	50	75	100	
Price	3.393	6.711	8.728	13.074	68.597	
Sales	0.049	15.479	47.345	109.002	577.313	
HP / weight	0.170	0.337	0.375	0.428	0.948	
Size	0.756	1.131	1.270	1.453	1.888	
MP\$	8.46	15.57	20.10	24.86	64.37	
MPG	9	17	20	25	53	

Variable	Percentile				
	0	25	50	75	100
Price	3.393	6.714	8.729	13.074	68.597
Sales	0.049	15.603	47.350	109.002	646.526
HP / weight	0.170	0.337	0.375	0.428	0.948
Size	0.756	1.131	1.270	1.453	1.888
MP\$	8.46	15.57	20.10	24.83	64.37
MPG	9	17	20	25	53

Table 3: Results with logit demand and marginal cost pricing (2217 observations)

	(a) Berry et al. (1995)			(b) Replication			
Variable	OLS logit demand	IV logit demand	OLS $\ln(\text{price})$ on w	Variable	OLS logit demand	IV logit demand	OLS $\ln(\text{price})$ on w
Constant	-10.068 (0.253)	-9.273 (0.493)	1.882 (0.119)	Constant	-10.069 (0.253)	-9.274 (0.493)	1.882 (0.119)
HP / weight	-0.121 (0.277)	1.965 (0.909)	0.520 (0.035)	HP / weight	-0.121 (0.277)	1.965 (0.909)	0.520 (0.035)
Air	-0.035 (0.073)	1.289 (0.248)	0.680 (0.019)	Air	-0.035 (0.073)	1.289 (0.248)	0.680 (0.019)
MP\$	0.263 (0.043)	0.052 (0.086)	—	MP\$	0.263 (0.043)	0.052 (0.086)	—
MPG	—	—	-0.471 (0.049)	MPG	—	—	-0.471 (0.049)
Size	2.341 (0.125)	2.355 (0.247)	0.125 (0.063)	Size	2.341 (0.125)	2.355 (0.247)	0.125 (0.063)
Trend	—	—	0.013 (0.002)	Trend	—	—	0.013 (0.002)
Price	-0.089 (0.004)	-0.216 (0.123)	—	Price	-0.089 (0.004)	-0.216 (0.023)	—
No. inelastic demands (+ / - 2 s.e.'s)	1494 (1429-1617)	22 (7-101)	n.a.	No. inelastic demands (+ / - 2 s.e.'s)	1494 (1429-1617)	22 (6-294)	n.a.
R^2	0.387	n.a.	0.656	R^2	0.387	n.a.	0.656

Table 4: Estimated parameters of the demand and pricing equations: BLP specification (2217 observations)

(a) Berry et al. (1995)				(b) Replication			
Demand side parameters	Variable	Parameter estimate	Standard error	Demand side parameters	Variable	Parameter estimate	Standard error
Means ($\bar{\beta}$'s)	Constant	-7.061	0.941	Means ($\bar{\beta}$'s)	Constant	-7.728	1.722
	HP / weight	2.883	2.019		HP / weight	4.620	1.682
	Air	1.521	0.891		Air	-1.226	2.059
	MP\$	-0.122	0.320		MP\$	0.293	0.233
	Size	3.460	0.610		Size	3.992	0.527
Std. Deviations (σ_{β} 's)	Constant	3.612	1.485	Std. Deviations (σ_{β} 's)	Constant	2.522	3.779
	HP / weight	4.628	1.885		HP / weight	3.525	4.236
	Air	1.818	1.695		Air	4.166	2.106
	MP\$	1.050	0.272		MP\$	0.393	0.419
	Size	2.056	0.585		Size	1.937	0.889
Term on price (α)	$\ln(y - p)$	43.501	6.427	Term on price (α)	$\ln(y - p)$	42.870	8.280
Cost side parameters	Constant	0.952	0.194	Cost side parameters	Constant	2.751	0.125
	$\ln(\text{HP / weight})$	0.477	0.056		$\ln(\text{HP / weight})$	0.812	0.089
	Air	0.619	0.038		Air	0.430	0.079
	$\ln(\text{MPG})$	-0.415	0.055		$\ln(\text{MPG})$	-0.610	0.073
	$\ln(\text{size})$	-0.046	0.081		$\ln(\text{size})$	-0.352	0.164
	Trend	0.019	0.002		Trend	0.027	0.002

Notes: Table focuses on the main BLP specification and omits two columns from an auxiliary specification.

Table 5: A sample from 1990 of estimated demand elasticities with respect to attributes and price (based on table 4 estimates)

(a) Berry et al. (1995)						(b) Replication					
Model	Value of attribute / price					Model	Value of attribute / price				
	HP / weight	Air	MP\$	Size	Price		HP / weight	Air	MP\$	Size	Price
Mazda 323	0.366	0.000	3.645	1.075	5.049	Mazda 323	0.366	0.000	3.645	1.075	5.049
	0.458	0.000	1.010	1.338	6.358		0.682	-0.000	0.516	1.717	4.033
Sentra	0.391	0.000	3.645	1.092	5.661	Sentra	0.391	0.000	3.645	1.092	5.661
	0.440	0.000	0.905	1.194	6.528		0.623	-0.000	0.447	1.476	4.009
Escort	0.401	0.000	4.022	1.116	5.663	Escort	0.401	0.000	4.022	1.116	5.663
	0.449	0.000	1.132	1.176	6.031		0.624	-0.000	0.528	1.453	3.872
Cavalier	0.385	0.000	3.142	1.179	5.797	Cavalier	0.385	0.000	3.142	1.179	5.797
	0.423	0.000	0.524	1.360	6.433		0.609	-0.000	0.315	1.681	3.933
Accord	0.457	0.000	3.016	1.255	9.292	Accord	0.457	0.000	3.016	1.255	9.292
	0.282	0.000	0.126	0.873	4.798		0.325	-0.000	0.152	0.715	3.310
Taurus	0.304	0.000	2.262	1.334	9.671	Taurus	0.304	0.000	2.262	1.334	9.671
	0.180	0.000	-0.139	1.304	4.220		0.159	-0.000	0.075	0.787	3.150
Century	0.387	1.000	2.890	1.312	10.138	Century	0.387	1.000	2.890	1.312	10.138
	0.326	0.701	0.077	1.123	6.755		0.368	0.624	0.155	0.842	6.128
Maxima	0.518	1.000	2.513	1.300	13.695	Maxima	0.518	1.000	2.513	1.300	13.695
	0.322	0.396	-0.136	0.932	4.845		0.232	0.238	0.075	0.283	4.972
Legend	0.510	1.000	2.388	1.292	18.944	Legend	0.510	1.000	2.388	1.292	18.944
	0.167	0.237	-0.070	0.596	4.134		0.117	0.103	0.032	0.139	3.668
TownCar	0.373	1.000	2.136	1.720	21.412	TownCar	0.373	1.000	2.136	1.720	21.412
	0.089	0.211	-0.122	0.883	4.320		0.022	0.020	0.016	0.151	3.185
Seville	0.517	1.000	2.011	1.374	24.353	Seville	0.517	1.000	2.011	1.374	24.353
	0.092	0.116	-0.053	0.416	3.973		0.061	0.034	0.013	0.116	2.981
LS400	0.665	1.000	2.262	1.410	27.544	LS400	0.665	1.000	2.262	1.410	27.544
	0.073	0.037	-0.007	0.149	3.085		0.063	0.020	0.012	0.094	3.039
BMW 735i	0.542	1.000	1.885	1.403	37.490	BMW 735i	0.542	1.000	1.885	1.403	37.490
	0.061	0.011	-0.016	0.174	3.515		0.056	-0.006	0.021	0.153	2.872

Notes (BLP 1995): The value of the attribute or, in the case of the last column, price, is the top number and the number below it is the elasticity of demand with respect to the attribute (or, in the last column, price.)

Table 8: A sample from 1990 of estimated price-marginal cost markups and variable profits (based on table 4 estimates)

(a) Berry et al. (1995)				(b) Replication			
Model	Price	Markup over MC ($p - MC$)	Variable profits (in \$'000's) $q(p - MC)$	Model	Price	Markup over MC ($p - MC$)	Variable profits (in \$'000's) $q(p - MC)$
Mazda 323	\$5,049	\$801	\$18,407	Mazda 323	\$5,049	\$1,269	\$29,158
Sentra	\$5,661	\$880	\$43,554	Sentra	\$5,661	\$1,442	\$71,371
Escort	\$5,663	\$1,077	\$311,068	Escort	\$5,663	\$1,717	\$495,787
Cavalier	\$5,797	\$1,302	\$384,263	Cavalier	\$5,797	\$2,082	\$614,302
Accord	\$9,292	\$1,992	\$830,842	Accord	\$9,292	\$2,889	\$1,205,400
Taurus	\$9,671	\$2,577	\$807,212	Taurus	\$9,671	\$3,427	\$1,073,448
Century	\$10,138	\$2,420	\$271,446	Century	\$10,138	\$2,966	\$332,782
Maxima	\$13,695	\$2,881	\$288,291	Maxima	\$13,695	\$2,812	\$281,343
Legend	\$18,944	\$4,671	\$250,695	Legend	\$18,944	\$5,239	\$281,156
TownCar	\$21,412	\$5,596	\$832,082	TownCar	\$21,412	\$7,582	\$1,127,369
Seville	\$24,353	\$7,500	\$249,195	Seville	\$24,353	\$10,294	\$342,044
LS400	\$27,544	\$9,030	\$371,123	LS400	\$27,544	\$9,184	\$377,478
BMW 735i	\$37,490	\$10,975	\$114,802	BMW 735i	\$37,490	\$13,368	\$139,829